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Carpathian and Harz Mountains, and in Westphalia; the sedimentary origin of some of these beds, however, is still in doubt; more typically sedimentary are some of the oölitic pyrite beds of Wabana. Ferrous sulphide is common in the limans of the Black Sea. The general explanation offered for these deposits is that of Doss, who believed that the iron is carried as a carbonate, upon which bacteria may act directly or indirectly to yield colloidal ferrous sulphide or ferric hydroxide, which in turn is converted into ferrous sulphide.

Various facts of importance to students of sedimentation are brought out in a discussion of the origin of the separate iron deposits; for instance, the experiments by Spring and Ruff on the conditions favoring and opposing the derivation of limonite from ferric hydroxide. It is shown, also, that primary deposits of ferric hydroxide may be readily altered to the carbonate, especially in the presence of large amounts of organic matter.

From a discussion of the inorganic causes for the precipitation of iron compounds as sediments, the writer returns to a consideration of organic causes. Here, especially in connection with the precipitation of ferric hydroxides, the line is not readily drawn between oxidation, taken as the purely inorganic process, and bacterial action; the latter, however, is surely of much importance, whether actually preponderant or not. The conditions under which iron-bearing bacteria are active vary between wide limits. Temperature, if too high or too low, may be inhibitory, as may also be a reduction in the amount of organic matter present.

To present in detail all the significant facts of this interesting paper, would necessitate a review as long as the original publication; it must be read to be fully appreciated. It displays both the clear thought and the technical skill of Mr. Harder in original work and his ability to join his observations to those of other investigators of the subject. All in all, it is a most admirable contribution to experimental geology.

C. H. B., JR.

Helium-Bearing Natural Gas. By G. SHERBURNE ROGERS. United States Geological Survey, Professional Paper 121. Washington, 1921.

This report comes from the press many months after the accidental death of its author in South America. It reflects so zealous a spirit of scientific research in the public service that it stirs anew the sorrow of his former associates at the passing of a geologist of such brilliancy and promise. The report perpetuates one of Mr. Rogers' contributions to the war needs of his country, namely the investigation of the occurrences of helium-bearing natural gas in the United States with a view to its utilization in dirigibles and military balloons.

Helium differs from hydrogen, the gas commonly used in balloons, in being non-inflammable; on the other hand it is about twice as heavy as hydrogen though still so much lighter than air that its lifting-power in air is 93 per cent that of hydrogen. Its advantages are so great that its use, both commercial and military, in airships is likely to be limited solely by the supply of helium available and the expense at which it can be produced.

The main body of this report is devoted to a description of the field occurrence of natural gases containing helium within the limits of the United States, but a brief discussion of possible sources of helium in other countries is included, and the report summarizes also, in very concrete and admirable fashion, the history of helium, its properties, and its relations to the radioactive elements, as well as the methods which have been applied for separating it from the commoner constituents of natural gases. The field work upon which the investigation rests consisted chiefly in collecting samples of gas for analysis and in gathering data regarding depth, geologic position, rock pressure, and volume of the gas sampled. This work involved careful examination of the geological structure in one or two areas, though a number of helium-rich districts had been previously studied by Survey geologists, and data on others were furnished by oil companies.

As a result of the investigations it is shown that although most of the natural gas produced in the eastern and central parts of the United States contains at least a trace of helium, gas containing more than $\frac{1}{2}$ per cent is known to occur only in two areas, one in northern Texas and the other in southern Kansas and northern Oklahoma. The helium-rich gas of the Kansas-Oklahoma area is confined to strata of Middle and Upper Pennsylvanian age, though gas carrying almost $\frac{1}{3}$ per cent of helium occurs in the Lower Pennsylvanian. The Mississippian and Permian gases in that locality are poor in helium. Conditions in the Texas area are almost identical. In Ohio gas carrying $\frac{1}{3}$ per cent of helium occurs in the Lower Mississippian and in the Clinton of the Silurian. Nearly all samples of Cretaceous gas from various parts of the United States show only traces of helium and most samples of Tertiary gas contain none.

Although traces of helium occur in most natural gas, noteworthy proportions have been found only in gas rich in nitrogen. The percentage in helium, moreover, seems to depend, in a measure, on the percentage of nitrogen, though there is not direct proportionality between the two. Some of the Kansas gases contain about 85 per cent of nitrogen and 2 per cent of helium.

After a discussion of the occurrence of helium in minerals and rocks, in mine gases and in the gases of mineral springs, volcanoes and fumeroles, the theories that have been advanced in explanation of the origin of the helium in natural gases are discussed. While recognizing that the origin of the helium is still a matter of great uncertainty, the writer is inclined to favor the view that the helium is derived from deposits of uranium and thorium, probably disseminated through the strata not far beneath the horizons at which the helium gas occurs.

E. S. Bastin

The Economic Aspects of Geology. By C. K. Leith. New York: Henry Holt and Company, 1921.

Because each year modern industry is becoming more technical, industrial progress has come to stride pace after pace with the development of science. Geology has shared with other sciences in the tightening of the bonds between science and industry. It is no longer necessary, as it was a generation ago, for the geologist to be continually bringing before the public the practical potentialities of his science; certain industries are now even snatching the half-fledged geologists from their academic nests. The increasing industrial importance of geology lays a new responsibility upon those engaged in the training of economic geologists, and Professor Leith's book, an embodiment of lectures given at the University of Wisconsin, drives home to the geology student in vigorous fashion not only the fundamental facts of useful mineral occurrence but also the rôle which each of these minerals plays in the economic life of the nation and of the world. The book is, in fact, an outgrowth of its author's war-time experiences during which he distinguished himself as a leader in the first real inventory of her mineral resources that the United States had ever taken.

The work is adapted to the use of students having an elementary knowledge of geology, such, for example, as is commonly acquired in the first year's work in college geology. While adapted for the use of